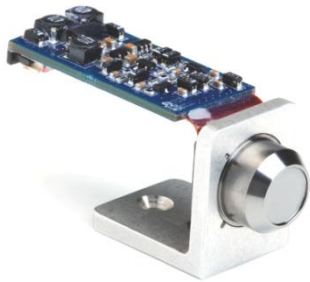


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# ***XPIN<sup>®</sup>-XT X-ray Detector Operation Manual***

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**XPIN-XT-AB**  
(Angle bracket sold separately)



**XPIN-XT-HS**  
(Heat sink sold separately)

# XPIN<sup>®</sup>-XT X-Ray Detector Operation Manual

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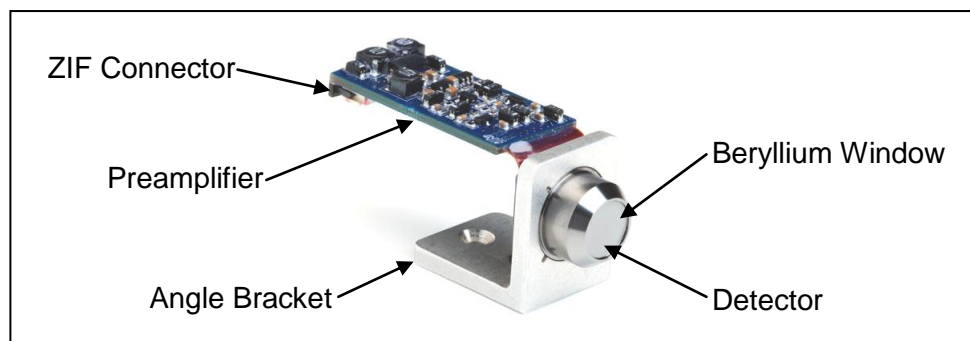
# XPIN<sup>®</sup>-XT X-Ray Detector Operation Manual

## XPIN-XT X-ray Detector

The XPIN-XT detector is a compact, low-cost Energy Dispersive X-Ray Florescence (EDXRF) detector. The XPIN-XT combines a silicon PIN diode, a Moxtek ultra-low-noise JFET, and a high performance two-stage thermoelectric cooler (TEC) achieving great resolution and x-ray sensitivity. The XPIN preamp provides a low-noise signal output to an analog or digital pulse shaping amplifier. This detector does not require any external cooling. *The XPIN-XT package is ideal for benchtop and portable applications where an integrated temperature controller is not required.*

## Initial Inspection

When the XPIN-XT detector is received, it should be unpacked and inspected as soon as possible. Inspect the detector and preamp for any damage that may have resulted during shipping. If the detector has been damaged, please contact Moxtek immediately. A serial number for identifying each detector is located on the preamp ZIF connector (See Figure 1).



**Figure 1 XPIN-XT-AB**  
(Angle Bracket Sold Separately)

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## Accessories

(Ordered separately)

- Angle bracket (see Figure 2)
- Heat sink (see Figure 3)
- Ribbon cable (see Figure 4)



Figure 2 XPIN-XT-AB



Figure 3 XPIN-XT-HS

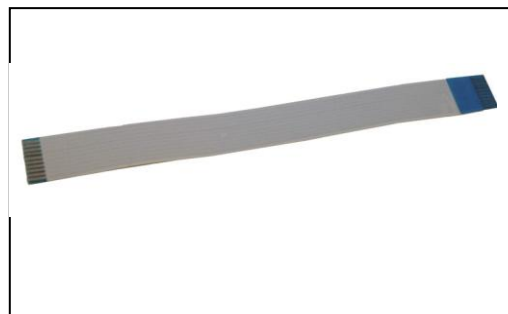


Figure 4 Ribbon Cable

## Detector Handling and Operating Precautions

Care must be taken not to damage the beryllium window. Excessive shock can damage both the detector and the thermoelectric cooler. Do not drop or allow the detector to strike any surface.

**CAUTION:** Moxtek detectors contain beryllium. Inhaling beryllium dust causes lung disease. Refer to the Beryllium Material Safety Data Sheet (MSDS).

**CAUTION:** The beryllium window can be easily damaged by improper treatment. Do NOT touch the beryllium window surface with anything, including a cotton swab or soft brush. Sudden impacts can damage the window.

**CAUTION:** Do not remove the lid from the case. If problems occur, contact Moxtek. The warranty will be voided if the lid is removed.

**CAUTION:** When supplying the detector with high voltage (HV), take precautions to avoid electric shock.

**CAUTION:** Check local, state, and/or federal regulations before disposing of the detector.

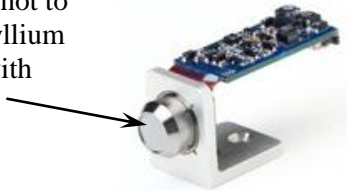
# XPIN<sup>®</sup>-XT X-Ray Detector Operation Manual

## Detector Setup

### Mechanical

Do not operate the XPIN-XT detector without a heat sink attached to the back of the detector using the number 4-40 stud at a recommended torque of 4 in-lbs. The XPIN-XT detector can be mounted in any direction using the number 4-40 stud. Exclude direct light from the bottom of the detector.

Take care not to touch beryllium window with anything



Insert ribbon to connector.  
If connector has latch, tighten.

### Electrical

Four voltages are required to operate the detector:

(See Appendix, Preamp Connector Pinouts)

- +5V ( $\pm 5\%$ ) @ 16mA for preamplifier power (Pin 3)
- -5V ( $\pm 5\%$ ) @ 20mA for preamplifier power (Pin 4)
- +170VDC for PIN Diode bias (Pin 10)
- Variable TE Cooler voltage (max +3.5VDC, max 0.56A) (Pin 2) to maintain desired internal temperature monitored by thermistor sensor (Pin 7).

When power is applied to the detector, the time between reset events on the output ramp signal will be very short. As the detector is cooled via the internal thermoelectric cooler the time between reset events will increase. Typically the time between resets will be between 0.25 seconds and 2 seconds when detector is at normal operating temperatures and no x-rays are applied to the detector. The internal temperature of the detector can be measured via the internal thermistor.

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## Operating the XPIN-XT Detector

When operating the XPIN-XT X-ray Detector, adhere to the maximum input specifications listed in the product datasheet. This document can be downloaded at our company website: [www.moxtek.com](http://www.moxtek.com).

Attach the detector to a power supply and a digital pulse processor or pulse shaping amplifier using the ribbon cable. Turn on the power to the preamplifier and then wait until the temperature controller has stabilized to the operating temperature before collecting spectrum. The resolution of the detector is not stable until the temperature is at the operating temperature. It is recommended that the detector be operated colder than  $-25^{\circ}\text{C}$ . Operating the detector at temperatures warmer than  $-25^{\circ}\text{C}$  will significantly reduce the resolution of the detector. Moxtek recommends standard operating of  $-35^{\circ}\text{C}$  or colder depending on the ambient temperature.

When the detector is operating, the signal out will look like a saw tooth ramp (shown in Figure 5.) The x-ray events are contained on the slope of the ramp. The detector will rail if a reset pulse is not set to bring the ramp back to the top. This is called a Reset Event. During the Reset Event there is no signal.

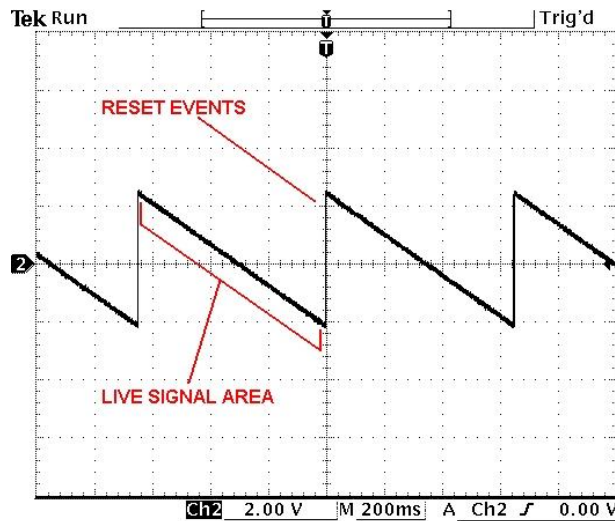


Figure 5 Ramp Signal

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Figure 6 shows a typical reset. The Reset Event is typically less than 20 $\mu$ S and goes from -2V to +2V.

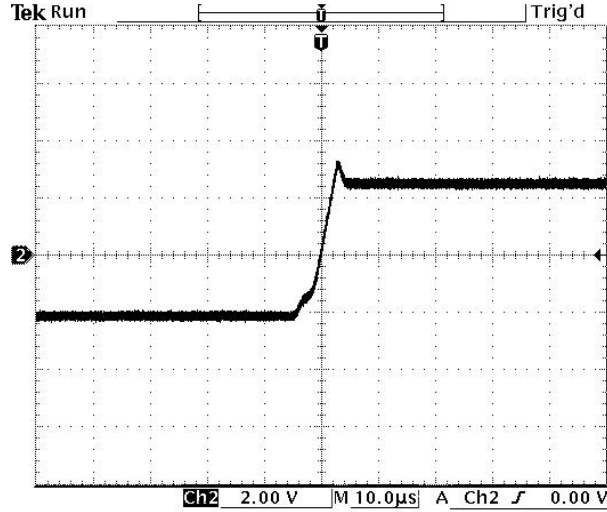


Figure 6 Reset Event

When the detector senses an x-ray, a step is created during the live signal area of the ramp. The height of the step corresponds to the energy of the x-ray, with larger steps meaning higher energy (see Figure 7).

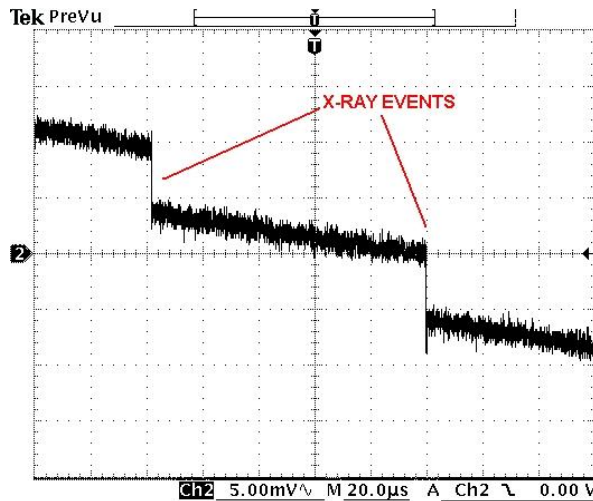


Figure 7 X-ray Events

# *XPIN<sup>®</sup>-XT X-Ray Detector Operation Manual*

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## **Technical Support**

For product technical support, please contact Moxtek at 801-225-0930 or at [www.moxtek.com](http://www.moxtek.com).

## **Warranty**

Please contact Moxtek for product warranty information (801) 225-0930. Failure to adhere to the specifications listed in the product datasheet and this operation manual may damage the detector and void the detector warranty.

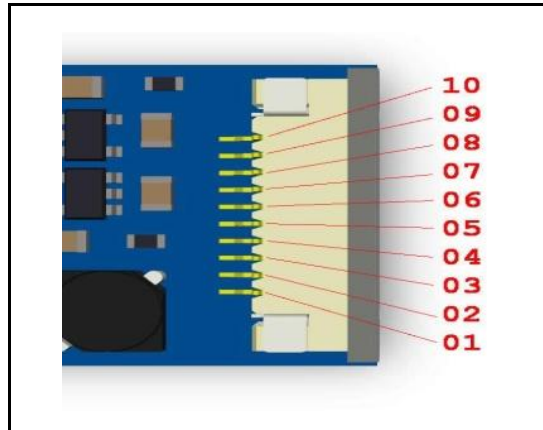




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## Appendix

### Preamp Connector Pinouts



**Figure 8 XPIN-XT X-ray Detector ZIF Connector**  
Connector manufacturer equivalent = FCI part # SFW10R-4STE1LF

Pin ID	Description	Set
1	TEC GND	GND
2	TEC +	+3.5 VDC Max
3	Detector Power	+5V
4	Detector Power	-5V
5	Detector Ground	GND
6	Detector Signal	NA
7	Thermistor	NA
8	Detector Ground	GND
9	Not Connected	-
10	HV Bias	+170 VDC

**Table 1 XPIN-XT X-ray Detector ZIF Connector Pin-outs**

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## XPIN Detector Module Pinouts

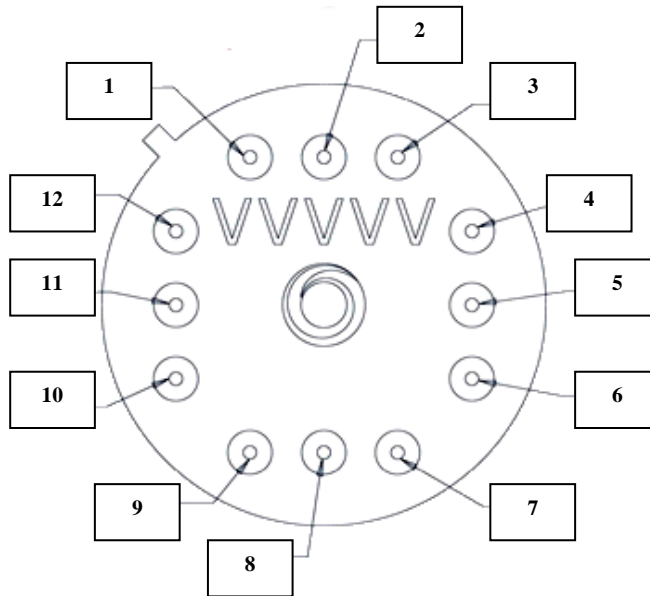


Figure 9 XPIN-XT X-ray Detector Pin-outs

Pin ID	Description
1	Not Connected
2	High Voltage Bias
3	Rest
4	Feedback
5	Substrate Voltage
6	Source
7	Drain
8	Ground
9	Thermistor +
10	TEC -
11	Thermistor -
12	TEC +

Table 2 XPIN-XT X-ray Detector Pin-outs

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## Temperature Sensor

The thermistor is a temperature sensitive resistor. The output of the thermistor is buffered to create feedback voltage on Pin 1 of the power connector. Refer to Table 3 and equation below for thermistor temperature vs. Pin 1 feedback voltage.

**Thermistor:** Betatherm 0.3K1CG2

### Thermistor Equation:

$$T = \frac{1}{A + B * LN(R) + C * LN(R)^3} - 273.15$$

### Where:

T = Temperature °C

R = Thermistor Resistance Ω

A = 0.0018590668

B = 0.0002367000

C = 0.0000007811

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**Table 3 Temperature vs. Thermistor Resistance (Pin 7)**

Temp °C	Resistance Ω
50	127.1
49	131.3
48	135.7
47	140.3
46	145.0
45	149.9
44	155.0
43	160.3
42	165.8
41	171.5
40	177.5
39	183.6
38	190.0
37	196.6
36	203.5
35	210.7
34	218.2
33	225.9
32	233.9
31	242.3
30	251.0
29	260.0
28	269.4
27	279.2
26	289.4
25	299.9
24	310.9
23	322.4
22	334.3
21	346.7
20	359.6
19	373.0
18	387.0
17	401.6
16	416.7
15	432.5
14	449.0
13	466.1
12	484.0
11	502.6
10	522.1
9	542.3

Temp °C	Resistance Ω
8	563.4
7	585.4
6	608.4
5	632.3
4	657.3
3	683.4
2	710.6
1	739.0
0	768.6
-1	799.6
-2	831.9
-3	865.6
-4	900.9
-5	937.7
-6	976.2
-7	1,016.4
-8	1,058.5
-9	1,102.4
-10	1,148.3
-11	1,196.4
-12	1,247.6
-13	1,299.2
-14	1,354.2
-15	1,411.7
-16	1,471.9
-17	1,534.9
-18	1,600.9
-19	1,670.0
-20	1,742.3
-21	1,818.1
-22	1,897.5
-23	1,980.7
-24	2,067.9
-25	2,159.3
-26	2,255.1
-27	2,355.5
-28	2,460.9
-29	2,571.4
-30	2,687.3
-31	2,808.9
-32	2,936.6
-33	3,070.6

Temp °C	Resistance Ω
-34	3,211.3
-35	3,359.1
-36	3,514.3
-37	3,677.3
-38	3,848.6
-39	4,028.6
-40	4,217.8
-41	4,416.8
-42	4,626.0
-43	4,846.0
-44	5,077.5
-45	5,321.0
-46	5,577.4
-47	5,847.2
-48	6,131.3
-49	6,430.5
-50	6,745.6
-51	7,087.6
-52	7,427.5
-53	7,796.3
-54	8,185.1
-55	8,595.1
-56	9,027.5
-57	9,483.7
-58	9,965.1
-59	10,473.3
-60	11,009.7
-61	11,576.2
-62	12,174.6
-63	12,806.7
-64	13,474.8
-65	14,180.9
-66	14,927.6
-67	15,717.1
-68	16,552.4
-69	17,436.2
-70	18371.6

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## XPIN-XT Mechanical Drawings

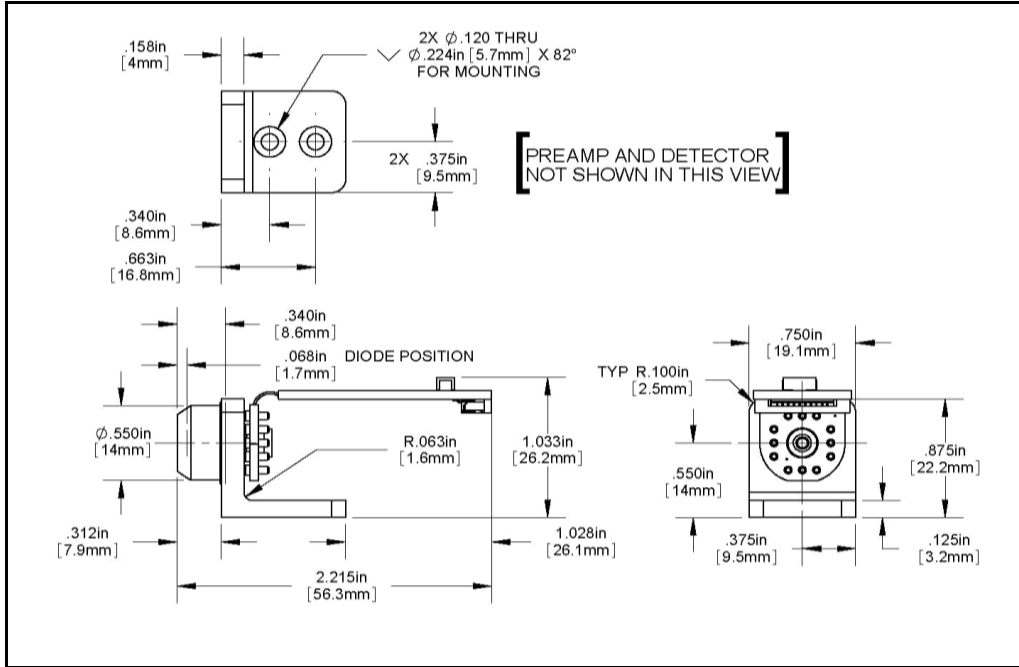


Figure 10 XPIN-XT-AB

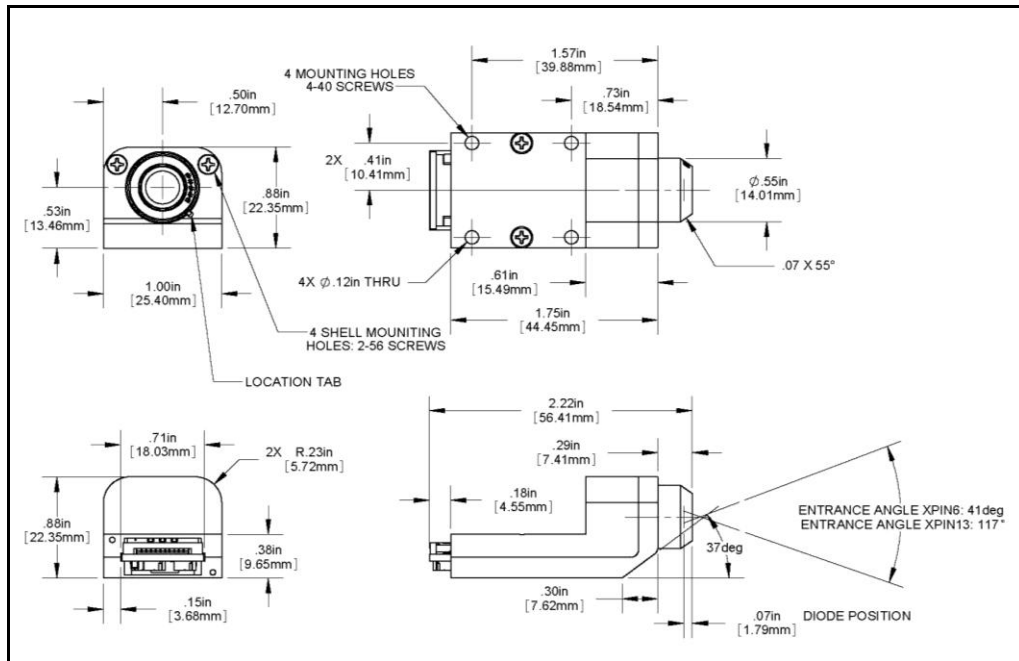


Figure 11 XPIN-XT-HS